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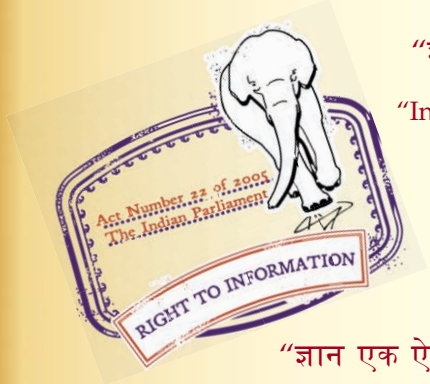
IS 7739-10 (1975): Code of Practice for Preparation of Metallographic Specimens, Part 10: Tin and its alloys and their examination [MTD 22: Metallography and Heat Treatment]



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IS : 7739 (Part X) - 1975
(Reaffirmed 2003)

Indian Standard

CODE OF PRACTICE FOR PREPARATION OF METALLOGRAPHIC SPECIMENS

PART X TIN AND ITS ALLOYS AND THEIR EXAMINATION

UDC 620·182·2 : 669·6

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs 5·00

June 1976

Indian Standard

CODE OF PRACTICE FOR PREPARATION OF METALLOGRAPHIC SPECIMENS

PART X TIN AND ITS ALLOYS AND THEIR EXAMINATION

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CODE OF PRACTICE FOR PREPARATION OF METALLOGRAPHIC SPECIMENS

PART X TIN AND ITS ALLOYS AND THEIR EXAMINATION

0. FOREWORD

0.1 This Indian Standard (Part X) was adopted by the Indian Standards Institution on 31 December 1975, after the draft finalized by the Metallography and Heat-Treatment Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The primary object of metallographic examination is to reveal the constituents and the structure of metals and their alloys by means of a microscope. Because of diversity in available equipment, wide variety of problems encountered, and the personal element, this standard gives for the guidance of the metallographer only those practices which experience has shown are generally satisfactory.

0.3 This standard is being issued in parts. This part covers polishing, etching and examination of tin and its alloys. The other parts of this code are given on fourth cover page.

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1. SCOPE

1.1 This standard (Part X) covers the polishing, etching and examination of tin and its alloys.

2. PREPARATION OF SPECIMENS

2.0 Recommended methods of selection, size, cutting, cleaning and mounting of metallographic specimens are outlined in Part I of this standard.

2.1 These metals are in a class with lead and its alloys and may advantageously be prepared similarly. Tin and its softer alloys may be prepared by microtoming, but the harder alloys may require one or two polishing steps before etching. Alternate polishing and etching is frequently desirable.

2.2 Specimens may be smoothed on a lathe with a tool having a sharp, smooth, cutting edge and large clearance, followed by polishing on emery papers from No. 0 to 000, lubricated with paraffin dissolved in kerosene. After the operation is completed on each paper, the specimen may be etched with hydrochloric acid (HCl) (10 to 20 percent), or other solution as required, for a short time to remove any metal that may have been flowed on the polished surface. The specimen is then polished on a broadcloth-covered wheel, using a solution of soap and levigated Alundum grain. The specimen is then again etched and finally polished on a second wheel covered with high-grade silk velvet using the same polishing medium as for the broadcloth. Alternate polishing and etching will be required to bring out the structure satisfactorily. (For details of grit numbers of abrasive papers, *see* IS : 715-1966* and IS : 2832-1964†.) A comparative chart of grit numbers of abrasive grains is given in Appendix A.

2.3 A solution of paraffin and kerosene may be prepared by dissolving 100 g of paraffin in 200 ml of warm kerosine. The solution of soap and levigated Alundum grain may be prepared as follows:

> 5 g of Alundum grain (Norton size No. 600 grain) added to 300 ml of water. After thorough agitation, the mixture is permitted to stand for 15 minutes, whereupon the supernatant suspension is decanted. To this decanted suspension 40 g of soap are added and the mixture heated until the soap is dissolved. Both mixtures are nearly solid at room temperature, so that it is necessary to use them warm. To remove the paraffin before etching, the samples are washed in warm kerosine and the kerosine is removed by washing the specimen with soap and water. The soap film may be dried on, or removed, in a strong stream of warm water.

2.4 The preparation of cross sections of tin plate so as to show, with the microscope, the tin coating and its structure, requires very careful polishing and support of the edge of the specimen. Bakelite lacquer with cellophane has been found to afford satisfactory edge support, and polishing with alumina on broadcloth and velvet has given good results.

3. ETCHING REAGENTS

3.1 In Table 1 are given the etching reagents commonly recommended for tin and its alloys.

3.2 After etching, the specimen is immediately and thoroughly washed with distilled water, followed by rinsing in a suitable medium (alcohol, acetone, etc) and drying to avoid staining. The specimen should be preserved, if required, in a desiccator.

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*Specification for coated abrasives, glue bond (*second revision*).

†Specification for waterproof silicon carbide paper.

TABLE 1 ETCHING REAGENTS FOR TIN AND ITS ALLOYS

(*Clause* 3.1)

Sl No.	Etching Reagent	Composition*	Remarks	Use
(1)	(2)	(3)	(4)	(5)
i)	Nital	HNO_3 2 to 5 ml Ethyl alcohol 95 to 98 ml	Swab or immerse for several minutes	Tin-cadmium or tin-iron alloys
ii)	Potassium dichromate	Acidified dilute solution	—	Tin-cadmium alloys
iii)	Mixed acids in glycerine	a) HNO_3 1 part Acetic acid 1 part Glycerine 8 parts	Immerse ½ to 10 minutes at 38 to 42°C	a) Tin-lead alloys
		b) HNO_3 1 part Acetic acid 3 parts Glycerine 5 parts	Same as for (a) above	b) Pure tin
iv)	Hydrochloric acid	a) HCl	a) Immerse for several seconds	a) To remove surface flow
		b) HCl 10 to 20 ml H_2O 90 to 80 ml	b) Immerse ½ to 5 minutes following (a)	b) Follows (a)
		c) HCl 10 ml H_2O 90 ml	c) Electrolytic etch at low current density	c) Tin-iron alloys
v)	Ferric chloride	$FeCl_3$ 10 g HCl 2 ml H_2O 95 ml	Immerse for ½ to 5 minutes at room temperature	Microetching of tin-rich babbitt metals
vi)	Acid ferric chloride	$FeCl_3$ 2 g HCl 5 ml H_2O 30 ml Ethyl alcohol 60 ml	Alternate polish and etch	For block tin
vii)	Nitric and hydrofluoric acid in glycerin	HNO_3 1 drop HF 2 drops Glycerine 25 ml	Etch for 1 minute at 20 to 27°C	For the tin coating on tin-plate
viii)	Ammonium polysulphide	Concentrated solution	Immerse for 20 to 30 minutes at room temperature	Macroetching of tin-rich babbitt metals

NOTE — Solutions of silver nitrate or 10 percent nitric acid plus 5 percent chromic acid are also occasionally used.

*The use of concentrated reagents is intended, unless otherwise specified.

APPENDIX A

(*Clause* 2.2)

COMPARATIVE CHART OF GRIT NUMBERS (APPROXIMATE) OF ABRASIVE GRAINS

Aluminium Oxide, Silicon Carbide and Garnet		Flint		Glass		Corundum		Emery		Trade Designation
IS Grit Number	B.S. Grade Number	IS Grit Number	B.S. Grade Number	IS Grit Number	B.S. Grade Number	IS Grit Number	B.S. Grade Number	IS Grit Number	B.S. Grade Number	
14	14	—	—	—	—	—	—	—	—	—
16	16	—	—	—	—	—	—	—	—	—
24	24	24	3	24	3	24	—	24	—	Extra Coarse
30	30	30	2½	30	2½	30	—	30	—	Extra Coarse
36	36	36	2	36	—	36	—	36	3	Coarse
40	46	40	1½	40	S2	40	—	40	2½	Coarse
50	54	50	1	50	M2	50	—	50	2	Medium Coarse
60	60	60	½	60	—	60	—	60	1½	Medium
80	80	80	—	80	—	80	—	80	1	Medium
100	100	100	0	100	F2	100	—	100	F	Medium Fine
120	120	120	00	120	1½	120	—	120	FF	Fine
150	150	150	—	150	1	150	—	150	—	Fine
180	180	180	—	180	0	180	—	180	0	Extra Fine
220	220	—	—	—	—	—	—	—	—	—

NOTE — Grits 240 and finer come under the sub-sieve range and as limits for these cannot be set on common silk test sieves, the grain sizes shall conform to general commercial grading, and it is recommended that the sedimentation process be adopted for their analysis.

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IS:

2756-1965 Method for estimating the average grain size of wrought copper and copper base alloys

2853-1964 Method for determining the austenitic grain size of steel

4075-1967 Methods of macro-streak flaw test for steel

4163-1967 Determination of inclusion content in steel by microscopic method

4748-1968 Method for estimating average grain size of metals

6396-1971 Methods of measuring decarburized depth of steel

6416-1971 Methods of measuring case depth of steel

7739 Code of practice for preparation of metallographic specimens:

(Part I)-1975 General features

(Part II)-1975 Electrolytic polishing

(Part III)-1975 Aluminium and its alloys and their examination

(Part IV)-1975 Copper and its alloys and their examination

(Part V)-1975 Iron and steel and their examination

(Part VI)-1975 Lead and its alloys and their examination

(Part VII)-1975 Magnesium and its alloys and their examination

(Part VIII)-1975 Nickel and its alloys and their examination

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Printed at Britannia Calendar Mfg Co, Calcutta, India